Notice No.1

Rules for the
Manufacture, Testing and Certification of Materials
July 2020

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Please note that corrigenda amends to paragraphs, Tables and Figures are not shown in their entirety.

Issue date: December 2020

Amendments to	Effective date	IACS/IMO implementation (if applicable)
Chapter 3, Section 3	1 January 2021	1 January 2021
Chapter 11, Sections 1, 3 & 5	1 January 2021	1 January 2021
Chapter 12, Sections 2 & 5	1 January 2021	1 January 2021
Chapter 13, Section 2	1 January 2021	1 January 2021

Lloyd's Register

Chapter 3
Rolled Steel Plates, Strip, Sections and Bars

■ *Section* 3
Higher strength steels for ship and other structural applications

3.1 Scope

3.1.1 Provision is made for material to be supplied in ~~four~~ five strength levels, 27S, 32, 36, ~~and~~ 40 and 47.

Existing paragraph 3.1.2 has been deleted.

Existing paragraph 3.1.3 has been renumbered 3.1.2.

~~3.1.4~~ 3.1.3 For the designation to fully identify a steel and its properties the appropriate grade letters should precede the strength level number, e.g. AH32 or FH40 and specify a suffix where applicable.

3.1.4 Provision is made for plates specifically intended for longitudinal structural members in the upper deck region of container ships (such as hatch side coaming, upper deck, hatch coaming top and the attached longitudinals etc.). The brittle crack arrest suffix is to be assigned to grades EH36, EH40 and EH47 in accordance with *Table 3.3.9 Requirement of brittle crack arrest properties for brittle crack arrest steels (Note 1)*, when the brittle crack arrest properties are demonstrated at the time of approval and at batch release.

3.1.5 The requirements of this Section are primarily intended to apply to plates, wide flats, sections and bars not exceeding the thickness limits given in *Table 3.3.1 Thickness limits*. ~~For greater t~~Thicknesses deviating from this table may be specially considered, in which case, variations in the mechanical properties requirements may be permitted or required for particular applications but a reduction of the required impact energy is not allowed.

Existing Table 3.3.1 has been deleted and replaced by the following;

Table 3.3.1 Thickness limits

<table>
<tr><td colspan="4" rowspan="2">Steel designation</td><td colspan="2">Thickness (t) limit mm</td></tr>
<tr><td>Plate and wide flat</td><td>Sections and Bars</td></tr>
<tr><td>AH27S</td><td>DH27S</td><td>EH27S</td><td>FH27S</td><td rowspan="4">Maximum 100</td><td rowspan="4">Maximum 50</td></tr>
<tr><td>AH32</td><td>DH32</td><td>EH32</td><td>FH32</td></tr>
<tr><td>AH36</td><td>DH36</td><td>EH36</td><td>FH36</td></tr>
<tr><td>AH40</td><td>DH40</td><td>EH40</td><td>FH40</td></tr>
<tr><td colspan="4">EH47</td><td>50 < t ≤ 100</td><td>Not applicable</td></tr>
<tr><td colspan="2" rowspan="2">Brittle Crack Arrest Steel</td><td colspan="2">EH36-BCA1, EH40-BCA1, EH47-BCA1</td><td>50 < t ≤ 100</td><td rowspan="2">Not applicable</td></tr>
<tr><td colspan="2">EH40-BCA2, EH47-BCA2</td><td>80 < t ≤ 100</td></tr>
</table>

3.3 Chemical composition

3.3.1 The chemical compositions of ladle samples for all grades of steel are to comply with the requirements of the approved manufacturing specification and the limits given in; ~~*Table 3.3.2 Chemical composition*~~ or ~~*Table 3.3.3 Chemical composition for Grade EH 47*~~

- *Table 3.3.2 Chemical composition for higher strength steels* and
- *Table 3.3.3 Carbon equivalent requirements for higher strength steels up to 100 mm in thickness when supplied in the TM condition*, or
- *Table 3.3.4 Chemical composition for brittle crack arrest steels*.

Existing Table 3.3.2 has been deleted and replaced with the following;

Table 3.3.2 Chemical composition for higher strength steels

Grades	AH, DH, EH	EH47	FH
Carbon % max.	0,18	0,18	0,16
Manganese %	0,9 – 1,60 (see Note 1)	0,9 – 2,0	0,9 – 1,60
Silicon % max.	0.50	0,55	0,50
Phosphorus % max.	0.035	0,020	0,025
Sulphur % max.	0.035	0,020	0,025
Grain refining elements (see Note 2)			
Aluminium (acid soluble) %	0,015 min. (see Note 3)		
Niobium %	0,02 – 0,05		
Vanadium %	0,05 – 0,10		
Titanium %	0,02 max.		
Total (Nb + V + Ti) % (see Note 5)	0.12 max.		
Residual elements			
Nickel % max.	0,40	1,0	0,80
Copper % max.	0,35	0,35	0,35
Chromium % max.	0,20	0,25	0,20
Molybdenum % max.	0,08	0,08	0,08
Nitrogen % max.			0,009 (0,012 max. if Al is present)

Note 1. For AH grade steels in all strength levels and thicknesses up to 12,5 mm, the specified minimum manganese content is 0,70%.

Note 2. The steel is to contain aluminium, niobium, vanadium or other suitable grain refining elements, either singly or in any combination. When used singly, the steel is to contain the specified minimum content of the grain refining element. When used in combination, the specified minimum content of each element is not applicable.

Note 3. The total aluminium content may be determined instead of the acid soluble content. In such cases the total aluminium content is to be not less than 0,020%.

Note 4. Alloying elements other than those listed above are to be included in the approved manufacturing specification.

Note 5. The grain refining elements are to be in accordance with the approved specification.

Existing Table 3.3.4 have been re-numbered as Table 3.3.3 and amended as below;

Table 3.3.43 Carbon equivalent requirements for higher ~~tensile~~ strength steels up to 100 mm in thickness when supplied in the TM condition

Grades	Carbon Equivalent, max (%)	
	t≤50 (Note 1)	50 < t ≤ 100 (Note 1)
AH 27S DH 27S EH 27S FH 27S	0,36	0,38
AH 32 DH 32 EH 32 FH 32	0,36	0,38
AH 36 DH 36 EH 36 FH 36	0,38	0,40
AH 40 DH 40 EH 40 FH 40	0,40	0,42
EH47 (Note 2)	Not applicable (*see Table 3.3.1 Thickness limits*)	0,49

Note 1. t = thickness in mm

Note 2. For EH47, the maximum Pcm is 0,22%

Existing Table 3.3.3 has been deleted and replaced with the following;

Table 3.3.4 Chemical composition for brittle crack arrest steels

Grades	EH36-BCA1	EH40-BCA1 EH40-BCA2	EH47-BCA1 EH47-BCA2
Carbon % max.	0,18	0,18	0,18
Manganese %	0,90 – 2,00	0,90 – 2,00	0,90 – 2,00
Silicon % max.	0,50	0,50	0,55
Phosphorus % max.	0,020	0,020	0,020
Sulphur % max.	0,020	0,020	0,020
Ni max.	2,0	2,0	2,0
Grain refining elements (Note 1 & 2)			
Aluminium (acid soluble) % (Note 3)	0,015	0,015	0,015
Niobium %	0,02 – 0,05	0,02 – 0,05	0,02 – 0,05
Vanadium %	0,05 – 0,10	0,05 – 0,10	0,05 – 0,10
Titanium %	0,02 max.	0,02 max.	0,02 max.
Total (Nb + V + Ti) %	0,12 max.	0,12 max.	0,12 max.
Residual elements (Note 4)			
Copper % max	0,50	0,50	0,50
Chromium % max.	0,25	0,25	0,50
Molybdenum % max.	0,08	0,08	0,08
Carbon equivalent C_{eq} max.	0,47	0,49	0,55
Cold cracking susceptibility P_{cm} max.	-	-	0,24

Note 1. The steel is to contain aluminium, niobium, vanadium or other suitable grain refining elements, either singly or in any combination. When used singly the steel is to contain the specified minimum content of the grain refining element. When used in combination, the specified minimum content of a fine graining element is not applicable.

Note 2. The grain refining elements are to be in accordance with the approved specification.

Note 3. The total aluminium content may be determined instead of the acid soluble content. In such cases the total aluminium content is to be not less than 0,020%.

Note 4. Alloying elements other than those listed above are to be included in the approved manufacturing specification.

3.3.2 The carbon equivalent is to be calculated from the ladle analysis using the formula given below and is not to exceed the maximum value agreed between the fabricator and the steelmaker when the steel is ordered.

$$Carbon\ \ equivalent = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

For TM steels, the agreed carbon equivalent is not to exceed the values given in ~~*Table 3.3.4*~~ *Table 3.3.3 Carbon equivalent requirements for higher ~~tensile~~ strength steels up to 100 mm in thickness when supplied in the TM condition*. For EH47 brittle crack arrest grade steels, the maximum carbon equivariant value is given in *Table 3.3.4 Chemical composition for brittle crack arrest steels*.

3.3.3 The cold cracking susceptibility, P_{cm}, may be used instead of the carbon equivalent for evaluating weldability, in which case the following formula is to be used for calculating the *P* cm from the ladle analysis:

$$P_{cm} = C + \frac{Si}{30} + \frac{Mn + Cr + Cu}{20} + \frac{Ni}{60} + \frac{Mo}{15} + \frac{V}{10} + 5B$$

The maximum allowable *P* cm is to be agreed with LR and is to be included in the manufacturing specification and reported on the certificate. For EH47 non brittle crack arrest steel, the maximum P_{cm} is given in *Table 3.3.3 Carbon equivalent requirements for higher strength steels up to 100mm in thickness when supplied in the TM conditions*; EH47 brittle crack arrest grade steels, the maximum P_{cm} value is given in *Table 3.3.4 Chemical composition for brittle crack arrest steels*.

Existing paragraph 3.3.4 has been deleted.

Exiting paragraphs 3.3.5 to 3.3.8 are have been re-numbered 3.3.4 to 3.3.7.

3.4 Condition of supply

3.4.1 All materials are to be supplied in a condition complying with the requirements given in *Table 3.3.5 Conditions of supply for plates and wide flats* or ~~*Table 3.3.7*~~ *Table 3.3.6 Conditions of supply for sections and bars*. Where alternative conditions are permitted, these are at the option of the steelmaker, unless otherwise expressly stated in the order for the material.

(Part only shown)

Table 3.3.5 Conditions of supply for plates and wide flats

Grade	Grain refining practice (*see* Note 1)	Thickness range mm	Conditions of supply (*see* Note 2)				
EH47	Any practice	≤50	Not applicable				
		>50 ≤100	-	-	-	TM	QT
EH36-BCA1 EH40-BCA1 EH40-BCA2 EH47-BCA1 EH47-BCA2	Any practice	≤50	Not applicable				
		>50 ≤100	-	-	-	TM (Note 5)	-
Note 5. Other conditions of supply may be accepted under special consideration.							

Table 3.3.7 to be re-numbered to Table 3.3.6 and re-position after Table 3.3.5

~~Table 3.3.7~~ Table 3.3.6 Conditions of supply for sections and bars

3.5 Mechanical tests and brittle crack arrest property tests

3.5.1 The results of all tensile tests and the average energy value from each set of three Charpy V-notch impact tests are to comply with the appropriate requirements given in the following tables:

- ~~*Table 3.3.6*~~ *Table 3.3.7 Mechanical properties for acceptance of Higher strength steel (see Note 1)*
- *Table 3.3.8 Mechanical properties for brittle crack arrest steel for acceptance purposes;* and
- *Table 3.3.9 Requirement of brittle crack arrest properties for brittle crack arrest steels*.

(Part only shown)

Table 3.3.~~6~~7 Mechanical properties for ~~acceptance purposes~~ acceptance of Higher strength steel (*see* Note 1)

Grades (*see* Note 3)	Yield Stress N/mm² min.	Tensile Strength N/mm²	Elongation on $5{,}65\sqrt{S_o}$ % min. (*see* Note 2)	Charpy V-notch impact tests (*see* Notes 3, 4, 5 and 6)					
				Average energy J minimum					
				t ≤ 50 mm		50 < t ≤ 70 mm		70 < t ≤ 100 mm	
				Longitudinal	Transverse	Longitudinal	Transverse	Longitudinal	Transverse
~~EH47~~	~~460~~	~~570-720~~	~~17~~	~~-~~	~~-~~	~~53~~	~~35~~	~~64 (*see* Note 1)~~	~~42 (*see* Note 5)~~
EH47	460	570-720	17	(Note 6)					

Impact tests are to be made on the various grades at the following temperatures:

AH grades 0°C

DH grades -20°C

EH grades -40°C

FH grades -60°C

Note 5. For steel of EH47 strength grade, the yield to tensile strength ratio is not to exceed 0,94.

Note 6. The Charpy V-notch impact energy for EH47 ~~in thickness between 85 mm and 100 mm are to be 75J~~ in the longitudinal direction ~~and 50J in the transverse direction~~ are as the following:

50 < t ≤ 70 mm 53J

70 < t ≤ 85 mm 64J

85 < t ≤ 100 mm 75J

Table 3.3.8 Mechanical properties for acceptance of brittle crack arrest steel

Grade	Yield Strength (N/mm²) min.	Tensile Strength (N/mm2)	Elongation (%) min.	Impact test (J) min. (Longitudinal)			
				Test Temp (°C)	50 < t ≤ 70 mm	70 < t ≤ 85 mm	85 < t ≤ 100 mm
EH36-BCA1	355	490-630	21	-40	41	50	50
EH40-BCA1 EH40-BCA2	390	510-650	20		46	55	55
EH47-BCA1 EH47-BCA2(Note 1)	460	570-720	17		53	64	75

Note 1: For EH47-BCA1 and BCA2 grades, the yield to tensile strength ratio is not to exceed 0,94.

Table 3.3.9 Requirement of brittle crack arrest properties for brittle crack arrest steels (Note 1)

Grade	Thickness (mm)	Crack Arrest Temperature CAT (°C) (*See* Note 2)
EH36-BCA1 EH40-BCA1	50 < t ≤ 100	-10 or below

EH47-BCA1 (See Note 1)		
EH40-BCA2 EH47-BCA2	80 < t ≤ 100	CAT corresponding to K_{ca}=8,000 N/mm$^{3/2}$ to be validated and approved by LR during manufacturer approval stage

Note 1. Brittle crack arrest steels are defined as steel plate with tested brittle crack arrest properties expressed as Crack Arrest Temperature (CAT) or crack arrest toughness K_{ca}. The crack arrest properties of the material are to be measured during the works approval stage and during the production test for batch release purpose.

To demonstrate the crack arrest properties for batch release purpose, validated small scale tests can be used. E.g. manufacturer can validate the relationship between CAT and the Nil Ductility Temperature or other properties by tests during the works approval stage to establish the correlation formula similar to the one below, or a version specified by the manufacturer which is validated by testing:

$$CAT = (NDTT+10) + [(\frac{\ln \sigma}{0,046}) - 105] + [153(B - 5)^{1/13} - 190]$$

where

CAT = crack arrest temperature in ^{o}C

NDTT = nil ductility test temperature in ^{o}C

σ = 2/3 of the minimum specified yield strength in N/mm^2

B = thickness of the plate in mm

The crack arrest test specimens are to be taken from each piece (the rolled product from a single slab or ingot if this is rolled directly into plates.

Note 2. As an alternative to crack arrest temperature (CAT), crack arrest properties may be demonstrated by large scale ESSO tests for BCA1 grades K_{ca}≥6000 N/mm$^{1.5}$ at -10°C and BCA2 grade K_{ca}≥8000 N/mm$^{1.5}$ at -10°C

3.5.7 ~~For crack arrest steels the brittle crack arrest test frequency is to be as stated in *Ch 3, 3.5 Mechanical tests 3.5.6*. Small scale test methods may be used to demonstrate brittle crack arrest properties, subject to approval of the test method prior to application~~ The brittle crack arrest properties specified in *Table 3.3.9 Requirement of brittle crack arrest properties for brittle crack arrest steels* are to be evaluated for the products in accordance with the procedure approved by LR during the works approval stage. Test specimens are to be taken from each piece (the rolled product from a single slab or ingot if this is rolled directly into plates).

Chapter 11
Approval of Welding Consumables

■ *Section 1*
General

1.2 Grading

(Part only shown)

Table 11.1.1 Welding consumable grades appropriate to structural and low temperature service steel grades

Consumables grade	Suitable for steel grades (*see* Notes)			
1. Ship Grade Steels (*Ch 3, 2 Normal strength steels for ship and other structural applications* and *Ch 3, 3 Higher strength steels for ship and other structural applications*)				
3Y	E	***EH27S***	***EH32***	***EH36***
4Y	—	***FH27S***	***FH32***	***FH36***
2Y40	***AH32***	***AH36***	***AH40***	—
2Y40	***DH32***	***DH36***	***DH40***	—
3Y40	***EH32***	***EH36***	***EH40***	—
4Y40	***FH32***	***FH36***	***FH40***	—
5Y40	***FH32***	***FH36***	***FH40***	—
3Y47	—	—	***EH40***	***EH47***
Note 4. Steel grades EH36, EH40, and EH47 also include corresponding brittle crack arrest steel grades referenced in *Ch 3, 3 Higher strength steels for ship and other structural applications*.				

■ *Section 3*
Electrodes for manual and gravity welding

3.2 Deposited metal test assemblies

(Part only shown)

Table 11.3.2 Requirements for deposited metal tests (covered electrodes)

Grade (*see* Note 3)	Yield stress N/mm^2 minimum	Tensile strength N/mm^2 (*see* Note 1)	Elongation on 50 mm % minimum	Charpy V-notch impact tests	
				Test temperature °C	Average energy (*see* Note 2) J minimum
3Y47	460	570 – 720	19	–20	~~53~~ 64

3.3 Butt weld test assemblies

Table 11.3.3 Requirements for butt weld tests (covered electrodes)

Grade (*see* Note 3)	Tensile strength N/mm^2	Bend test ratio: $\frac{D}{t}$	Charpy V-notch impact tests	
			Test temperature °C	Average energy (*see* Note 1) J minimum
				All positions (*see* Note 2)
3Y47	570 - 720	4	–20	~~53~~ 64

■ *Section 4*

Wire-flux combinations for submerged-arc automatic welding

4.3 Deposited metal test assemblies (multi-run technique)

(Part only shown)

Table 11.4.2 Requirements for deposited metal tests (wire-flux combinations)

Grade	Yield stress N/mm^2 minimum	Tensile strength N/mm^2	Elongation on 50 mm % minimum	Charpy V-notch impact tests	
				Test temperature °C	Average energy (*see* Note) J minimum
3Y47	460	570 – 720	19	–20	~~53~~ 64

4.4 Butt weld test assemblies (multi-run technique)

(Part only shown)

Table 11.4.3 Requirements for butt weld tests (wire-flux combinations)

Grade	Tensile strength N/mm^2	Bend test ratio: $\frac{D}{t}$	Charpy V-notch impact tests	
			Test temperature °C	Average energy (*see* Notes 1 and 2) J minimum
3Y47	570 – 720	4	–20	~~53~~ 64

Chapter 12
Welding Qualifications

■ *Section 2*

Welding procedure qualification tests for steels

2.7 Destructive tests for steel butt welds

Existing paragraph 2.7.13 has been deleted and replaced with below.

2.7.13 Hardness surveys:

(a) A Vickers hardness survey is to be performed on the macro specimen taken from the weld start end of the test assembly in accordance with that shown in *Figure 12.2.14 Hardness testing locations for butt welds*, using a test load not in excess of 10 kg. For each row of indents, there are to be a minimum of 3 individual indentations in the weld metal, the heat affected zones (both sides), the base metal (both sides), and in addition, 2 indentations are required in the grain coarsened heat affected zone, one above and one below the hardness survey row. The recommended distance between indents is 1,0 mm, but the distance between indents should not be less than the minimum specified in ISO 6507/1.

(b) For steel grades EH47, EH47-BCA1 and EH47-BCA2 an additional row of indents is required from the mid-thickness of macro specimen.

2.12 Mechanical test acceptance criteria for steels

2.12.4 **Impact toughness tests:**

Table 12.2.2 Impact test requirements for butt joints (*t* ≤ 50 mm) *see* Notes 1 and 2

Grade of steel	Test temperature (°C) *see* Note 4	Average energy (J) minimum, *see* Note 4		
		Manual or semi-automatic welded joints		Automatically welded joints
		Downhand, Horizontal, Overhead	Vertical upward, Vertical downward	
A, *see* Note 3	20	47	34	34
B, *see* Note 3, D	0			
E	-20			
AH32, AH36	20			
DH32, DH36	0			
EH32, EH36	-20			
FH32, FH36	-40			
AH40	20		39	39
DH40	0			
EH40	-20			
FH40	-40			
Note 1. ~~Steel grade EH47 is not permitted in thickness less than 50 mm, *see* Note 2, *Table 3.3.1 Maximum thickness limits* in Chapter 3,~~ The impact test requirements for steel grade EH47 are detailed in *Table 12.2.3 Impact test requirements for butt joints* in *Ch 12, 2 Welding procedure qualification tests for steels*.				

(Part only shown)

Table 12.2.3 Impact test requirements for butt joints (*t* > 50 mm) *see* Notes 1 and 2

Grade of steel	Test temperature (ºC) *See* Note 2	Average energy (J) minimum, *see* Note 2		
		Manual or semi-automatic welded joints		~~Vertical upward, Vertical downward~~ Automatically welded joints
		Downhand, Horizontal, Overhead	~~Automatically welded joints~~ Vertical upward, vertical downward	
EH32, EH36, EH36-BCA1	–20	47	41	41
EH40, EH40-BCA1, EH40-BCA2	–20	50	46	46
EH47, EH47-BCA1, EH47-BCA2	–20	64	64	64
Note 1. These requirements are to apply to test piece of which butt weld is perpendicular to the rolling direction of the plates. Note 2. For the Naval ships, both the test temperature and value of minimum absorbed energy are to be those specified for the parent material.				

Existing paragraph 2.12.6 has been deleted and replaced with below.

2.12.6 **Hardness surveys:**

(a) The maximum hardness value is not to exceed 350 Hv for steel grade EH47 and 380 Hv for steel grades EH47-BCA1 and EH47-BCA2.

(b) For all other steel grades, the maximum hardness value is not to exceed 350 Hv for steels with a specified minimum yield strength up to ≤420 N/mm^2, nor exceed 420 Hv for steels with a specified minimum yield strength in the range 420 N/mm^2 to 690 N/mm^2.

2.15 Range of approval

(Part only shown)

2.15.8 **Range of material types:**

(c) The range of approval for the crack arrest steel grades is shown in Table 12.2.5 Range of approval for crack arrest steel grades. Welding procedures qualified on non-brittle crack steel grades are also considered applicable to corresponding brittle crack arrest steel grades where production heat input does not exceed 50 KJ/cm. For higher heat input, the welding procedures are to be qualified on crack arrest steel grades.

Guidance: As an example, the corresponding crack arrest steel grades for non-brittle crack arrest steel grade EH40 are EH40-BCA1 and EH40-BCA2.

Existing listed items (c) to (f) have been renumbered d to g.

Existing Tables 12.2.5 and 12.2.6 have been renumbered Tables 12.2.6 and 12.2.7.

Table 12.2.5 Range of approval for crack arrest steel grades

Material grade for the test assembly	Range of Approval
EH36-BCA1	EH36-BCA1
EH40-BCA1	EH40-BCA1
EH40-BCA2	EH40-BCA2, EH40-BCA1
EH47-BCA1	EH47-BCA1
EH47-BCA2	EH47-BCA2, EH47-BCA1

■ *Section 5*
Welder qualification tests

5.6 Range of approval

(Part only shown)

Table 12.5.2 Welder qualification materials groupings

Material group	Material description	Typical LR Grades	Rules for Material references
WQ 01	Low carbon unalloyed, C/Mn, or Low alloyed steels (Re ≤ ~~360~~ 390 N/mm^2), or steel strength grade H 47.	A, B, D and E ~~AH to FH32 and 36~~ AH27S to FH40, EH36-BCA1, EH40-BCA1, EH40-BCA2, EH47, EH47-BCA1, EH47-BCA2 Boiler 510FG and lower ~~LT-AH to FH32 and 36~~ LT-AH27S to LT-FH40	*Ch 3, 2 Normal strength steels for ship and other structural applications* *Ch 3, 3 Higher strength steels for ship and other structural applications* *Ch 3, 4 Steels for boilers and pressure vessels* *Ch 3, 6 Carbon–manganese and nickel alloy steels for low temperature service*

WQ 03	~~High strength fine grained,~~ ~~Normalised or quenched, or~~ High strength steels (Re > 390 N/mm^2), or ~~Tempered structural steels (2,0 – 5% Ni, with Re > 360 N/mm^2)~~ Ferritic low temperature nickel steels	~~AH to FH40 to 69~~ ~~LT-AH to LT-FH40~~ AH42 to FH69 1½, 2¼, 3½ Ni steels and castings U3, R3, R3S and R4	~~*Ch 3, 3 Higher strength steels for ship and other structural applications* and *Ch 10 Equipment for Mooring and Anchoring*~~ ~~*Ch 3, 6 Carbon–manganese and nickel alloy steels for low temperature service*~~ *Ch 3, 10 High strength steels for welded structures* *Ch 3, 6 Carbon–manganese and nickel alloy steels for low temperature service*, *Ch 4, 7 Ferritic steel castings for low temperature service* and *Ch 6, 4 Ferritic steel pressure pipes for low temperature service* *Ch 3, 9 Bars for welded chain cables* and *Ch 10 Equipment for Mooring and Anchoring*

Chapter 13
Requirements for Welded Construction

■ *Section 2*
Specific requirements for ship hull structure and machinery

2.4 Construction and workmanship

2.4.10 For steel grades EH47, EH47-BCA1 and EH47-BCA2, the following additional requirements are applicable:

(a) When the ambient temperature is 5°C or less, or where moisture resides on the surfaces to be welded, due care is to be taken to pre-heat the joint to a minimum of 50°C, unless a higher pre-heat temperature is specified. Alternative preheat requirements will be specially considered where Pcm of the material being welded is less than or equal to 0,19 and the air temperature is below 5°C but above 0°C.

(b) The tack length may be 25 mm where Pcm of the material being welded is less than or equal to 0,19.

Published by Lloyd's Register Group Limited
Registered office (Reg. no. 08126909)
71 Fenchurch Street, London, EC3M 4BS
United Kingdom